

7.8 Whiritoa Urban Non-Serviced



7.8.1 Description

The township of Whiritoa lies in a small bay on the western Bay of Plenty, between Waihi Beach and Whangamata (Figure 1). Provision of infrastructural services to Whiritoa is a responsibility of the Hauraki District Council, which is the administrative authority for the area. A system for wastewater collection, treatment and disposal has served the community since 1989/90, prior to when all households relied on septic tanks. Currently only a small number of properties remain unconnected to the wastewater system. Whiritoa does not have a public water supply system, the provision of water supply being the responsibility of individual owners. From a recent survey of residents, it was estimated that some 69% of households draw their water from wells (bores) and the remainder from roof catchments -except for a small number drawing directly from a stream.



Figure 1:

Location of Whiritoa township, on the western shore of the Bay of Plenty.

7.8.2 How is Drinking Water Obtained

Individual households provide their own water supply, generally either from wells (bores; 69% of households sampled in a Hauraki District Council survey) or from rainwater tanks (17%) or both (12%). It is not known how representative the sample is of the population as a whole, as the sample was not randomly selected. Survey forms were deposited at the general store and customers invited to take a form, complete it and post it. In all, 62 householders did, of whom 42 were from the urban area. It is possible that households with wells were over-represented in the survey.

The households responding to the survey account for up to 34 wells (69% + 12% of 42 properties). A search of Environment Waikato files produced information on 113 wells in Whiritoa and one in Mataora Bay. While it is possible that some wells exist that are not recorded in the Environment Waikato database, the number of these is likely to be small. It is suggested, therefore, that only about 26% of households use groundwater (with or without rainwater) and that the majority of the remainder rely on rainwater. A small number -one of 42 in the survey -use stream water.

7.8.3 Risks Attributable to the Absence of a Reticulated Water Supply

There may be a small risk of groundwater contamination, particularly as the majority of wells are relatively shallow. For the protection of the individual households – and for the community at large if a contagious disease is contracted from one or more wells – householders should be enjoined to upgrade and maintain their in-house filter systems to full filtration and disinfection.

Groundwater tapped by most of the existing wells is from a non-secure source so existing supplies to at least 26% of households are at risk of biological contamination. Given such factors as:

1. the relatively coarse-grained nature of the sand and gravels that most of the wells appear to be founded in,
2. the aquifer is not confined or otherwise a secure source,
3. the relatively recent history of septic tank usage and discharge to the ground and

For a holiday population of 2,140 persons, some 560 persons face a risk of contamination of their drinking water.

At least one household (one of 42 respondents in Council's survey) uses stream water. Although the actual catchment was not identified, parts of all the local catchments include grazing land and/or bush with the associated probability of faecal and protozoan contamination due to livestock and feral animals. In addition, the head of a tributary catchment of the Whiritoa Lagoon is the location for the Whiritoa wastewater treatment plant (refer Figure 2) and its associated effluent disposal area (an irrigated eucalyptus plantation).

The remainder of households use rainwater collection from roof catchments. Potential contamination arises from birds, opossums, cats and other animals as well as airborne contaminants. Some households using roof catchments also have wood fires, adding carcinogens to the range of possible contaminants. While the probability of contamination is low, it is not zero.

Some households use water filters which, if of correct specification and properly maintained, could reduce risk of protozoan contamination. However, such filters do not address either bacterial or chemical contaminants. Many designs provide a substrate for the growth of bacteria and other organisms in biofilms.

To render the existing supplies safe will require upgrading of individual household “filtration” systems. Those with correctly specified filter elements may require the addition of UV sterilisers; others will also require filters. Households with wood fires and roof collection should consider the addition of activated carbon filters. With plumbing and wiring, cost per household could be around \$2,500 for a competent system. Depending on usage, annual costs for electricity, replacement of lamps and filter elements could amount to around \$1,000.

7.8.4 Quality and Adequacy of Drinking Water

Information on water use was obtained from the summary of wastewater flows in the Wastewater AMP. This reported average daily flows of 60 m³/day from a resident population of 243 (equivalent to 247 litres/cap.day) and a peak of 297 m³/day. Depending whether peak population is taken as 1,500 (Asset Management Plan) or 2,240 (Council survey) the peak demand is equivalent to 198 l/cap.day or 133 l/cap.day, respectively. There is no commercial, industrial or extraordinary use reported for Whiritoa urban area; all water use is domestic.

7.8.4.1 Source Water Quality

7.8.4.1.1 Chemical Parameters

Information on groundwater, provided from EW files, included results of water quality tests on samples from a number of the wells at Whiritoa. Most of the sampling was done during 1992 to 1995, although a few were more recent. A selection of those results was assessed and characterised. It was observed that the samples for Well 60-3 showed higher contaminant concentrations than the other samples, which are from deeper wells. Information on four of the wells reported is tabulated below.

Well ID (Station)	Depth	Stratigraphy	Geology
60-3	5.5		
63-59	15		
63-65	17.5	Sands	Rhyolite
63-8	22.5	Sands	

The water in well 60-3 was almost brackish but, considering the well is only 5.5 metres deep, is unlikely to be affected by seawater intrusion. Possible reasons for high sodium levels include ion exchange within the aquifer and influence of septic tank effluent contamination; assessment of the key ionic ratios does not indicate evidence of saline intrusion.

Samples from the deeper wells show the deeper groundwater to be of excellent chemical quality and markedly superior to that from the shallow well. In particular, concentrations of iron, manganese, boron and arsenic are all acceptably low. Characterisation of existing wells by depth is set out in the following table.

Depth range	Number	Depth range	Number
Less than 10 m	21	30 to 40 m	5
10 to 20 m	51	Greater than 40 m	4
20 to 30 m	10	Unknown	22

The deepest well for which information was provided was 90 m deep.

7.8.4.1.2 Biological Determinands

Bacteriological testing showed groundwater to be of highly variable quality. The table below provides a summary of the bacteriological testing.

Total No. Wells tested	8	Total No. Samples tested	22
No. Negative samples: Total coliform	3	Range of positive samples: Total coliform [No. Per ml]	1 to 500
No. Negative samples: Faecal coliform	8	Range of positives: Faecal coliform [No. Per ml]	1 to >180

The results show that groundwater, especially from shallow wells, was not of potable quality. The samples were mostly taken during the early 1990s when residuals from septic tank discharges will still have been present in the groundwater. No recent bacteriological test results were available so it cannot be confirmed whether quality has improved in the interim. No results were available for protozoan contamination.

7.8.5 Current and Future Demands for Water Supply

Council’s Wastewater Asset Management Plan¹⁰ states the permanent resident population of Whiritoa as 243 persons (2001 census) and holiday peak as 1500 persons. Currently there are 439 properties within Whiritoa but it is estimated that this number could increase to 600 dwelling units connected in the future due to infill developments within the existing conurbation and with the proposed rezoning of rural residential land to residential. The Asset Management Plan considers the long term possibility of a peak season population of 8,000.

The Council undertook an occupancy survey of some 44 properties and found maximum holiday numbers of 214 persons accounted for in those 44 properties, equivalent to 4.86 persons per household. Extrapolating to the 439 existing properties, Council estimated present peak population to be 2,240 persons, within ±5%.

Excluding land in Maori title, there are some 6.8 ha of land in large lots (Rural Residential) which, if rezoned and subdivided to a similar density to the balance of the township, could increase the number of properties by some 15%, to 505. Allowing for infilling by cross-leases, multiple units or townhouses, a total of 600 dwellings is an appropriate figure for assessment of possible future demand. At the peak occupancy rate determined from the household survey, estimated peak population is therefore 2,920 persons. This compares with the wastewater system design peak population of 4,000.

¹⁰ Hauraki District Council: Wastewater Asset Management Plan -DRAFT -Version 6 -30/6/04

A future peak population of 8,000, as proposed in the Wastewater AMP, could not be accommodated within the existing urban zone boundaries, except by extensive redevelopment to higher-density housing. Alternatively, the additional numbers might be accommodated if the urban boundary were to be extended at some time. In this report, for the purposes of assessment of impacts and feasibility, a design peak population of 4,000 is used. Options have been kept open for further extension to 8,000 at some more distant future time.

Wastewater peak flows are reported to be 297 m³/d, from a holiday population of 1,500, which is equivalent to 198 l/cap.day. Therefore, a design per capita consumption of 200 litres per day, is proposed, which is consistent with accepted design guidelines. Thus, design demand (system capacity required) is 800 m³/day for the peak of 4,000 population. Provision may be required for up to 1,600 m³/day in the more distant future.

7.8.6 Options Available to Meet the Demands and their Suitability

Consideration was given to provision of a public water supply as far back as 1967, by the local authority of the day (the former Ohinemuri County Council). A number of options were considered but the project was shelved due to a perception of the cost being excessive for the small community. A residents’ petition in the summer of 1972/73 pleaded for a community water supply to be provided.

Historically, focus for a water source for a public system has been on the Whiritoa Stream and the Ramarama Stream. Both flow from upland catchments with a good vegetated cover (bush and/or forest). Dialogue between the Ohinemuri County and the New Zealand Forest Service indicated a preference for use of the headwaters of the Whiritoa Stream.

Groundwater was also suggested as an option, in 1984, by the Hauraki Catchment Board.

For this report estimates of low flows were obtained from Environment Waikato (EW) for the Whiritoa Stream, Ramarama Stream and Waiharakeke Stream. Information was also obtained from EW files on wells within Whiritoa and the surrounding area; data on 114 wells was provided including stratigraphy, location, depth, test flows and water quality.

Environment Waikato provided estimates of stream low flows for the Whiritoa Stream, Ramarama Stream and Waiharakeke Stream. Flows are expressed as Low Flow Assessments as a surrogate for the more usual five-year-low-flow (Q₅) as there is currently insufficient information to determine Q₅ with certainty. For the purposes of this report the low flow assessments have been taken as equivalent to Q₅. The figures provided by EW are presented in columns (1), (2) and (3) in the following table.

Site	(1) Catchment area km ²	(2) Specific discharge l/s/km ²	(3) Low flow assessment l/s	(4) Available resource m ³ /day
Whiritoa Stream at SH 25	6.1	4.9	30	780
Ramarama Stream at SH 25	7.7	5.2	40	1040
Waiharakeke Stream at SH 25	26.1	7.1	185	4800

Available resource– column (4) in the above table– was calculated from the EW data and represents 30% of the low flow assessment on the basis that EW usually requires a minimum flow of 70% of the Q_5 value to be maintained in the stream for in-stream values. That means that the available resource could be reduced whenever the stream flow is less than Q_5 , during a less frequent dry-weather flow. Comparing the available resource estimates with design demands for a communal system:

- all sources could meet demand (430 m³/d) from an existing holiday population (2,140)
- the Whiritoa Stream is unsuitable and Ramarama Stream is marginal for a demand of 800 m³/d due to a design population of 4,000
- the Waiharakeke Stream can confidently meet both the immediate design of 800 m³/day and the ultimate design demand of 1,600 m³/day.

All of the stream sources will be subject to variable water quality -particularly high colour, dissolved organic matter and sediments -from time to time, requiring a sophisticated treatment system for a consistent supply of potable-quality water. Good control of process will be required to ensure protection from biological contaminants.

The locations of the respective catchments relative to Whiritoa are shown in Figure 2.

The risks associated with the pastoral land uses in the lower reaches of the Waiharakeke Stream could be mitigated by locating an intake upstream of the highway, near the limits of the bush cover. The low flow assessment would reduce, due to the reduced catchment area, but will still be more than sufficient for the ultimate design population.

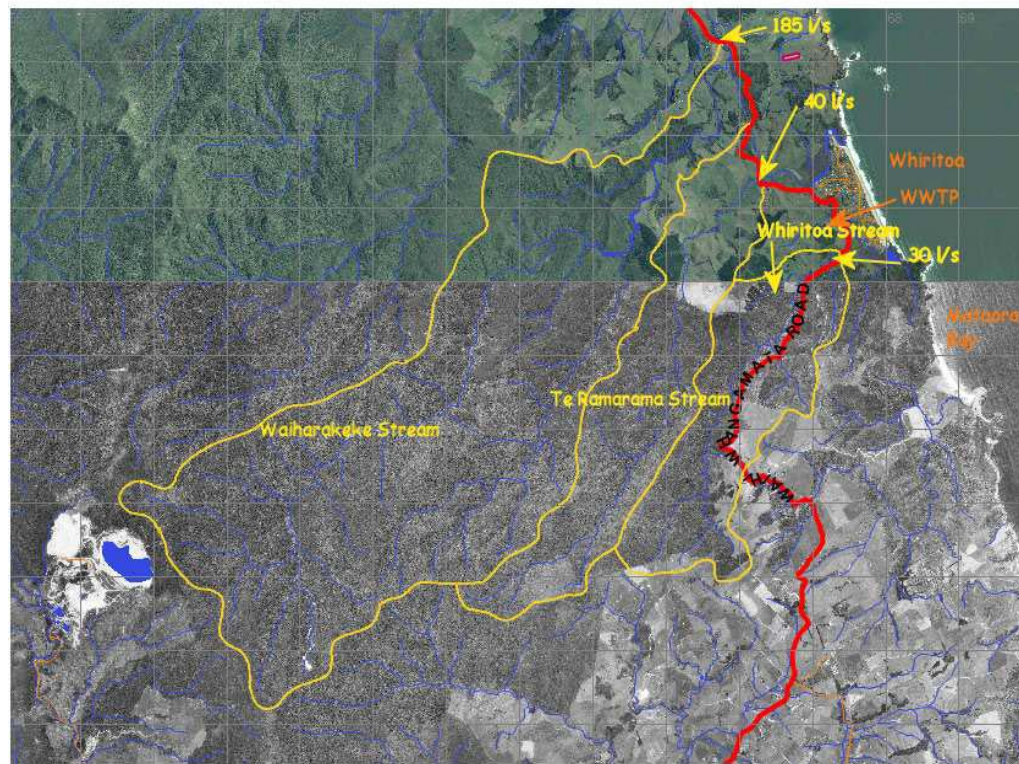


Figure 2:

Stream catchments with potential to supply water to Whiritoa and their geographical relationship to the township. Low flow assessments are shown at the respective reference sites.

Anecdotal evidence and EW records point to ample supplies of good quality groundwater being available in the area, although a site-specific investigation will be necessary to verify this. The geological map of the area¹¹ identifies the regional geology as volcanic rocks of the Coromandel Group and the strata underlying and surrounding Whiritoa as andesitic rocks of the Waiwawa Subgroup. The type variously includes "... tuff breccia and volcanoclastic sediments ... local, non-welded, dacitic, pumice-rich ignimbrite...." Such rocks are capable of producing good flows of water, particularly where the parent rock is well fractured. High-producing wells in this formation are reported in the hinterland at Whangamata and at Mataora Bay.

Subject to confirmation by exploratory drilling and testing, it is considered that a sufficient supply could be obtained by drilling into the andesite rocks in the vicinity of the State Highway. Depending on the character of the rocks two wells might be needed to produce the design flow of 800 m³/day but having two wells and associated pumping equipment will allow for good operational flexibility throughout the year.

Within Whiritoa township the andesite rocks are overlain by alluvium which, although producing good flows for domestic supplies, carries a high risk of contamination and should not be considered.

7.8.6.1 Treatment Requirements

7.8.6.1.1 Groundwater

Subject to a suitable aquifer being located and developed, treatment requirements for groundwater from the andesite rocks will be minimal. Expected processes and options include:

- an automatic strainer (e.g. Arkal, Amiad, Tekleen) to protect downstream infrastructure from sand ingress
- UV disinfection for protozoa if the supply cannot be confirmed as a secure supply
- chlorination, if required for protection of the water in service.

7.8.6.1.2 Surface Water

Treatment is required to deal with colour, dissolved organics, suspended solids and biological contaminants. Enhanced coagulation will be required to ensure taste and odour problems are avoided and disinfection by-products are kept within limits. Based on a conventional plant, the process train should include:

- enhanced coagulation -e.g. alum with pH control and polyelectrolyte
- process control for coagulation -e.g. streaming current or UV absorbance/on-line colour with turbidity
- controlled flocculation
- clarification
- filtration and either
- UV disinfection for bacteria, or
- chlorination,
- monitoring of process variables including turbidity, pH, chlorine residual (if used).

On the basis of information gathered for this report the existing water supply – depending, as it does, on shallow groundwater, roof catchments and surface streams – carries potential risk to human health. New testing is needed to verify

¹¹ Geology of the Auckland Area; 1:250000 Geological Map. S.W. Edbrooke (compiler); IGNIS, 2001

that the level of risk associated with the existing arrangements is consistent with reliable safe potable water supply to the community.

Currently, a holiday population estimated at more than 2,200 persons may be exposed to these risks; indirect exposure occurs to the home communities of holiday makers on their return from Whiritoa.

In theory it would be possible to upgrade existing, on-site supplies by incorporation of additional filters (or initial installation where none now exist) and UV sterilisers. Allowing for wiring, plumbing and carpentry in some cases plus the supply of components at an average \$2,500 per household, the impact on the community as a whole is something over \$1 million. Annual costs for power, lamp replacements and filter elements are likely to be around \$1,000 per annum for permanently occupied premises. However, monitoring the performance of these systems for compliance and to ensure ongoing maintenance is carried out will be impractical. There may be a strong case to be argued in favour of a community supply for Whiritoa.

Assuming the Director-General of Health does not intervene, the community may elect to ignore the risks. A consumer survey by Council indicated a majority (of 42 respondents) were opposed to having to pay for a community system but it is suggested that the respective supplies may be less wholesome than the owners are aware. Respondents in the survey also indicated a willingness to have their supplies sampled and tested by Council. It is recommended that sampling and testing be carried out and the results discussed with owners before commitment is made to a community system.

In the event that the case is confirmed for a community system, the preferred options are either:

- a groundwater supply from a well or wellfield constructed on land adjacent to SH 25, or
- a surface water supply drawn from the Waiharakeke Stream.

The suggestion of the Waiharakeke Stream is made without knowledge of any political or land tenure issues that may rule this out as an option. It has been assumed that land and/or easements for construction access and for siting of intakes, treatment, pipelines and other infrastructure can be obtained.

7.8.6.2 Suggested System Configurations

The following configurations are based on identical reticulation systems, fed from a reservoir assumed to be located on elevated ground to west of SH25 (see Figure 3). The suggested location is close to the community and offers elevations in excess of 80 metres above sea level for placement of a reservoir, which will provide sufficient head for gravity reticulation. Availability of this land will be subject of negotiation and has not been determined in the study for this report.



Figure 3:

Hills to the west of SH25 provide ample elevation for a gravity-driven reticulation.

Pipe sizes shown in the following sections are indicative only and must be subject to detail design.

7.8.6.2.1 Groundwater Supply

The following elements will be the minimum required to provide a supply system from groundwater (assuming the developed aquifer is found to be a secure supply):

- a well drilled into land adjacent to SH 25 -say, 200 mm diameter, to 60 metres deep
- a control building (say, 6m×3m plan) to house electrical cabinet, control equipment, automatic strainer and chlorination equipment
- automatic strainer (Arkal or similar) and chlorination (sodium hypochlorite)
- rising main (500 m×150Ø) to elevated ground west of SH25
- treated water storage reservoir (1,000 m³) on elevated land to be obtained west of SH25
- gravity feed main (150Ø) to the township via Whiritoa Beach Road
- distribution pipes and rider mains around the township.

If the source is not found to be secure, a UV steriliser would be added to the process for protozoan inactivation; chlorination could be retained for in-service protection.

7.8.6.2.2 Surface Supply

The following elements will be required to provide a safe, potable supply from surface water (Waiharakeke Stream):

- a screened raw water intake on the Waiharakeke Stream, near to the bush line, at an elevation around 40 m

a gravity feed main (2.8 km×300Ø, subject to survey and design)

- a treatment plant control building, say 14×6m with electrical supply, controls, instrumentation, transfer pumping, filters, dosing pumps, chemical storage and batching
- chemical dosing systems -e.g. alum, soda ash, polyelectrolyte -with process monitoring and control -streaming current or UV with raw water turbidity, flow monitoring, chlorine residual, filtrate turbidity
- mixing and flocculation reactors,
- (at least) one clarifier, 4m diameter

- (at least) two filters -e.g. pressure filters 2.1m diameter
- boost pumps for filtration (unless gravity filters are used)
- chlorination system
- transfer pumps for treated water to the treated water reservoir
- rising main (3,800m×200ø) to storage
- treated water storage reservoir (1,000 m³) on elevated land to be obtained west of SH25
- gravity feed main (150ø) to the township via Whiritoa Beach Road
- distribution pipes and rider mains around the township.

Activated carbon dosing may be required to mitigate taste and odour problems if algae problems persist in the raw water source. UV sterilisation may be considered if achieving the target turbidity of 0.1 NTU for >95% of time (for protozoa compliance) proves elusive or to mitigate disinfection by-product generation.

7.8.6.3 Cost Impacts

No allowance is made in the following estimates for costs associated with land acquisition. Neither is any allowance included for costs associated with obtaining resource consents.

7.8.6.3.1 Groundwater Source

Capital: Estimated, rough-order costs for the works as described in S. 7.8.6.2.1, including a contingency sum (20%) and allowance for fees for design, management, supervision (15%) \$ 850,000

Operating: Allowing for 10 hours pumping for 60 days per year and 2.5 hours for the balance; 20 kW borehole pump; 2 manhours per week for service and maintenance; amortising the capital cost at 8% interest over 20 years, the annual cost is equivalent to \$207 per household. An additional, one-off cost is required for making a connection to each household.

7.8.6.3.2 Surface Source

Capital: Estimated, rough-order costs for the works as described in S 7.8.6.2.2, including a contingency sum (20%) and allowance for fees for design, management, supervision (15%) \$ 2,500,000

Operating: Allowing for 10 hours pumping for 60 days per year and 2.5 hours for the balance; 30 kW transfer pump; 2 manhours per day for service and maintenance; chemicals at 10c per m³; amortising the capital cost at 8% interest over 20 years, the annual cost is equivalent to \$700 per household. An additional, one-off cost is required for making a connection to each household.

7.8.6.3.3 Status Quo

Upgrading individual on-site treatment systems to ensure safe, potable water is estimated to require up to \$2,500 per household; annual costs are expected to be up to \$1,000 per year per household, depending on the design and configuration of the individual systems.

7.8.6.4 Incorporation with Existing Infrastructure

Existing infrastructure consists, variously, of rainwater tanks, wells and associated pumping systems at each property. It is expected – subject to confirmation on a site-by-site basis – that the pumping system on each site has a single point of connection to the internal plumbing circuit of each house. To connect a community supply it will be necessary to isolate the existing pumped feed from the house

plumbing and connect a new service pipe from the street main to the house plumbing.

The existing source and pumping systems could be retained for ex-house use, although this will likely require pipework for new hose taps and connection points. The cost should be minor in most cases.

If existing infrastructure is to be retained in this way, owners will need to be informed of the health risks associated with use of the water. Notices [“Not for Drinking”] may need to be installed at each tap.

7.8.6.5 Risks Associated with Options

Risks to a communal system supplied from (deep) groundwater are considered very low, particularly if the source is found to be secure. The main risks will be those due to recontamination during storage and delivery; with good management and control, the risks due to such occurrences will be very low.

There is a possibility, in any coastal aquifer, of contamination by seawater intrusion. However, the likelihood of occurrence should be very low if the supply well(s) is (are) located inland. Subject to confirmation by investigation and testing, seawater intrusion is not expected to be a problem if the well or well field is located in the vicinity of SH 25.

If the communal system is sourced from surface streams the level of risk increases (over groundwater sources) due to the additional complexity of the system and due to the increased range of potential threats. A surface water treatment plant will require more frequent attention for recalibration and adjustment of processes and will be vulnerable to events such as slips in the catchment and to pollution from animals (faecal) and other sources (e.g. spills). Not all such events can be adequately dealt with by the process control infrastructure although the probability of occurrence should be low.

A supply based on surface flows is also at greater risk of loss or diminution of supply during drought events.

7.8.7 Hauraki District Council’s Involvement in Meeting the Demands

The following steps are recommended to first confirm the need for a community supply on health risk grounds and then to proceed with investigation and implementation:

- Carry out sampling and testing of a representative number of existing supplies, including rainwater, groundwater and surface water. In addition to bacterial testing (total and faecal coliforms and streptococci), chemical testing should include, as a minimum: all major anions and cations, nitrate, nitrite, iron, boron, manganese and arsenic. Groundwater samples should be collected from wells having different depths and geology, including both the shallow sands and the native, andesitic rocks.
- If testing confirms that the existing supplies are not safe and potable, conduct consultation with the community to ascertain true attitudes to, and willingness to pay for, a community system.
- Undertake test drilling near SH25 to locate a suitable vein of the andesite aquifer. Construct a well or wellfield with sufficient capacity to meet design demands – 450 m³/day short term. Make provision for pump upgrades or the incorporation of a second well or additional wells to provide up to 800 m³/day.
- Obtain land and easements; build and commission appropriate treatment, storage and reticulation infrastructure.